

REMARKS

Reconsideration and allowance of the present patent application based on the foregoing amendments and following remarks are respectfully requested.

By this Amendment, claims 1, 3-5, 7, 9, 17-19, 21-22 and 28 are amended, claims 6, 24-25 and 29-30 are cancelled without prejudice or disclaimer to the subject matter therein and claims 31 and 32 are newly added. Support for the amendment to the claims may be found throughout the specification. No new matter has been added. After entry of this Amendment, claims 1, 3-5, 7-9, 17-19, 21-23, 28 and 31-32 will remain pending in the patent application.

Claims 1, 3-9, 17-19 and 21-30 were rejected under 35 U.S.C. §103(a) based on Nguyen *et al.* (U.S. 2001/0009154 A1) (hereinafter “Nguyen”) in view of Ivankovits *et al.* (U.S. Pat. No. 5,213,621) (hereinafter “Ivankovits”) and Senzaki *et al.* (U.S. Pat. No. 6,090,960) (hereinafter “Senzaki”). The rejection is respectfully traversed.

Claims 6, 24-25 and 29-30 are cancelled without prejudice or disclaimer, thus rendering moot the rejection of these claims.

Claim 1 recites a cleaning method for removing a metal film formed inside a treatment apparatus that is configured to form a metal film on a substrate, the treatment apparatus comprising (a) a first source supplying a treatment agent; (b) a second source supplying a cleaning agent comprising one of a carboxylic acid and a derivative of a carboxylic acid; (c) a vaporizer vaporizing the treatment agent and the cleaning agent; (d) a first pipe connecting the first source and the vaporizer, and supplying the treatment agent from the first source to the vaporizer; (e) a second pipe connecting the second source and the vaporizer, and supplying the cleaning agent from the second source to the vaporizer; (f) a chamber for forming the metal film on a substrate; (g) a susceptor mounting the substrate in the chamber; (h) a third pipe connecting the vaporizer and the chamber, and supplying the vaporized treatment agent or the vaporized cleaning agent from the vaporizer to the chamber; (i) a vacuum pump exhausting the chamber; and (j) a heat source heating the vaporizer, the third pipe, and the chamber, the method comprising, *inter alia*, (ii) reducing a pressure in the chamber, the third pipe, and the vaporizer; (iii) heating the vaporizer, the third pipe, and the chamber by the heat source over a predetermined temperature; (iv) supplying the cleaning agent comprising one of the carboxylic acid and the derivative from the second source to the vaporizer through the second pipe to vaporize the cleaning agent; and (v) supplying the

vaporized cleaning agent from the vaporizer into the chamber through the third pipe. Nguyen does not disclose, teach or suggest a method of cleaning including these features.

Nguyen merely discloses a method of cleaning interior surfaces of a metal vapor deposition chamber by oxidizing the surface to be cleaned with oxygen plasma and then removing the oxide products by using hydrolyzed hexafluoroacetylacetone (Hhfac) to volatilize the oxide products. (*See FIG. 2*).

However, unlike claim 1, Nguyen does not disclose, teach or suggest, for example, (ii) reducing a pressure in the chamber, the third pipe, and the vaporizer; (iii) heating the vaporizer, the third pipe, and the chamber by the heat source over a predetermined temperature; (iv) supplying the cleaning agent comprising one of the carboxylic acid and the derivative from the second source to the vaporizer through the second pipe to vaporize the cleaning agent; and (v) supplying the vaporized cleaning agent from the vaporizer into the chamber through the third pipe.

Nguyen merely discloses introducing an oxygen gas into the chamber to promote oxidation of the surfaces to be cleaned. (*See paragraph [0040]*). Nguyen discloses that the chamber includes a chuck 24, a pump 22 and an inlet port 14 in communication with a shower head 16. Nguyen is, however, silent as to an apparatus that includes a first source, a second source, a first, second and third pipe, a vaporizer and a heat source, as in claim 1. As a result, Nguyen cannot disclose reducing a pressure in the third pipe and the vaporizer, heating the third pipe and the vaporizer, supplying the cleaning agent from the second source to the vaporizer and supplying the vaporized cleaning agent from the vaporizer into the chamber through the third pipe.

Ivankovits fails to remedy the deficiencies of Nguyen. Ivankovits merely discloses a process for cleaning metal-containing contaminants from a surface of a substrate of the type used in fabricating integrated circuits and semiconductors by using a cleaning agent, for example trifluoroacetic acid. (*See col. 2, lines 37-67 and col. 4, lines 9-25*). However, Ivankovits does not provide any teachings as to reducing a pressure in the third pipe and the vaporizer, heating the third pipe and the vaporizer, supplying the cleaning agent from the second source to the vaporizer and supplying the vaporized cleaning agent from the vaporizer into the chamber through the third pipe. Ivankovits does not even hint at an apparatus including a first source, a second source, a first, second and third pipe, a vaporizer and a heat source, as in claim 1.

Similarly, Senzaki fails to remedy the deficiencies of Nguyen and Ivankovits. Senzaki merely discloses applying chemical vapor deposition copper to integrated circuit

substrates. However, Senzaki does not disclose, teach or suggest reducing a pressure in the third pipe and the vaporizer, heating the third pipe and the vaporizer, supplying the cleaning agent from the second source to the vaporizer and supplying the vaporized cleaning agent from the vaporizer into the chamber through the third pipe. Senzaki is silent as to an apparatus including a first source, a second source, a first, second and third pipe, a vaporizer and a heat source, as in claim 1.

Accordingly, any reasonable combination of Nguyen, Ivankovits and Senzaki cannot result, in any way, in the invention of claim 1. Therefore, Applicants respectfully submit that claim 1 is patentable over Nguyen, Ivankovits and Senzaki and a combination thereof.

Furthermore, Applicants respectfully submit that there is no motivation or suggestion to combine the teachings of the references. Nguyen discloses a method of cleaning interior surfaces of a metal vapor deposition chamber. By contrast, Ivankovits is merely directed to cleaning a substrate. The processes used by these references are different. Therefore, by virtue of being silent as to each other's features, Applicants respectfully submit that it would not have been obvious to modify the teachings of one of these references in view of the other. For at least this reason, Applicants respectfully submit that the Examiner has not established a *prima facie* case of obviousness.

Claims 3-5, 7-9, 17-19, 21-23, and 28 are patentable over Nguyen, Ivankovits and Senzaki and a combination thereof at least by virtue of their dependency from claim 1 and for the additional features recited therein.

Accordingly, reconsideration and withdrawal of the rejection of claims 1, 3-5, 7-9, 17-19, 21-23, and 28 under 35 U.S.C. §103(a) based on Nguyen in view of Ivankovits and Senzaki are respectfully requested.

Claims 31-32 are newly added and define additional subject matter that is novel and non-obvious based on the art of record. Claims 31-32 are patentable over the art of record at least by virtue of their dependency from claim 1 and for the additional features recited therein.

Applicants have addressed the Examiner's rejection and respectfully submit that the application is in condition for allowance. A notice to that effect is earnestly solicited.

If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, please contact the undersigned at the telephone number listed below.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

Respectfully submitted,

PILLSBURY WINTHROP SHAW PITTMAN LLP

  
CHRISTOPHE F. LAIR  
Reg. No. 54248  
Tel. No. 703.770.7797  
Fax No. 703.770.7901

ERH/CFL/smm  
P.O. Box 10500  
McLean, VA 22102  
(703) 770-7900